WHAT IS CLAIMED IS:

1. Apparatus comprising a first thin photosentitive sol-gel film (including an organometallic photosentizer) on a substrate containing oxygen and silicon, said sol-gel film including at least first and second spaced apart regions which include $Si\ O_2$ with a high index of refraction channel therebetween, said channel including $Si - O - M - O - Si$ where M is a metal, said channel including different indices of refraction along the axis thereof.

2. Apparatus as in claim 1 wherein said substrate comprises glass.

3. Apparatus as in claim 1 wherein said substrate comprises silicon, said substrate including a surface layer of silicon dioxide.

4. Apparatus as in claim 1 wherein said first channel includes $Si - O - M - O - Si$ said channel having a relatively high index of refraction compared to that of adjacent regions of said film, said channel including at least a portion comprising alternating regions of $Si - O - M - O - Si$ and $Si\ O_2$ for defining a grating.

5. Apparatus as in claim 4 wherein said regions of SiO_2 have different dimensions along the axis of said channel.

6. Apparatus comprising a substrate having a silica surface layer, said apparatus including a thin sol-gel glass film thereon, said thin sol-gel film including therein at least a first metal oxide waveguide channel having a relatively high refractive index.

7. Apparatus as in claim 6 also including first and second electrodes formed astride said metal oxide with electro-optic properties channel and responsive to a voltage impressed thereon to vary the index of refraction locally therein.

8. Apparatus as in claim 7 including a plurality of metal oxide waveguide channels each comprising Si – O – M – O – Si where M is a metal taken from a class consisting of groups IVA and IVB, Group VI, transition metals and rare earth metals from the periodic table the index of refraction in said channels varying differently in each.

9. Apparatus as in claim 6 wherein said substrate comprises a glass.

10. Apparatus as in claim 6 wherein said substrate comprises silicon having a surface layer of silicon dioxide.

11. Apparatus comprising a substrate having a silica surface layer, said apparatus including a thin sol-gel glass film thereon, said sol-gel film including therein at least first and second metal oxide (waveguide) channels, said channels being in close proximity only in a first region thereof, said apparatus including signal-responsive means for switching light signals from said first to said second channel controllably.

12. A method for forming a high refractive index metal oxide waveguide channel in a sol-gel derived glass, said method comprising the steps of forming a photosensitive sol-gel film including an organometallic photosensitizer on a silica substrate said method comprising the steps of exposing said film through a mask to light of a wavelength and for a time for unbinding different amounts of metal constituents and of said sensitizer in different sections along at least a first channel thereof, exposing said film to heat at a first temperature and for a time to drive off the unbound sensitizer and to bind the metal constituents of said sol-gel film, and exposing said layer to heat at a second temperature higher than said first temperature for a time to unbind and drive off the organic constituents of said sol-gel film.

13. A method as in claim 12 wherein the step of exposing said layer to ultraviolet light is carried out through a photo mask for confining said light to a first channel of said film, and for defining second and third unexposed regions to first and second sides of said channel, said unexposed regions defining first and second interfaces with said first channel respectively.

14. A method as in claim 13 wherein said step of exposing said layer to ultra violet light through a photo mask defines a plurality of spaced – apart first channels, each of said first regions having first and second interfaces with second and third unexposed regions respectively, said channels having differently varying indicies of refraction therealong.

15. Apparatus comprising a substrate having a silicon dioxide surface, said apparatus including a photosensitive sol-gel derived glass film thereon, said film including at least a first channel therein having an index of refraction sufficiently higher therein than the index of refraction in adjacent regions to confine therein light introduced at an input thereof, said channel having a continuous variation in index of refraction therealong.

16. Apparatus as in claim 15 including a first plurality of said channels organized along closely spaced paths between said input and an output, each of said channels having a continuously-varying index of refraction different from that of any other one of said channels..

17. Apparatus as in claim 16 wherein each of said channels is configured to transmit light of a different wavelength.

18. Apparatus as in claim 1 wherein the index of refraction in said channel changes in a manner to define spaced apart Bragg gratings for reflecting light therebetween.

19. Apparatus as in claim 18 in which said channel comprises Si – O – M – O - Si and said adjacent regions comprise SIO where Si is silicon, O is oxygen and M is a metal.

20. Apparatus as in claim 1 also including first and second electrodes connected to said channel at first and second interfaces with said adjacent regions to first and second sides thereof.

21. Apparatus as in claim 16 comprising a plurality of photosensitive sol-gel derived glass films, said apparatus including n pluralities of said channels arranged in each of said film each of said n pluralities extending between an input and an output.

22. Apparatus as in claim 20 also including means for impressing a voltage between said first and second electrodes.

23. Apparatus as in claim 1 wherein a portion of said channel comprises magnetic material, said apparatus also including means for generating a magnetic field in at least said portion of said channel.

24. Apparatus as in claim 22 wherein said electrodes are connected to a first portion of said channel and said channel divides into first and second derivative channels at said portion.

25. Apparatus as in claim 23 wherein said means for generating is coupled to a first portion of said channel and said channel divides into first and second derivative channels at said portion.

26. Apparatus as in claim 1 having a plurality of high index of refraction channels therein extending from a common input to a common output, each of said channels having a different radius of curvature for providing a low loss transmission path for a different wavelength therein.

27. Apparatus as in claim 26 also including fiber optic means for introducing at said input light having a band of wavelengths including each of said different wavelengths.

28. Apparatus as in claim 27 wherein said film includes means for dividing said band of wavelengths into a set of individual wavelengths, one for each of said channels.

29. Apparatus as in claim 27 including at least a second sol-gel film on said first sol-gel film, said second sol-gel film also including a plurality of high index of refraction channels therein extending from a common input to a common output, each of said channels in said second film having a different radius of curvature for providing a low loss transmission path for a different wavelength therein.

30. Apparatus as in claim 28 having first and second optical fibers coupled to the common inputs of said first and second film respectively for introducing input light having a band of wavelengths including each of said different wavelengths.

31. A method for forming a multilayered sol-gel film device, said method comprising the steps of 1) forming a first sol-gel film including components R – M – X on a substrate containing SiO_2, 2) exposing the film to light through a mask for unbinding X and binding M, 3) heating the film at a first temperature and for a time to drive off X and permanently bind M to SiO_2, 4) heating the film at a second higher temperature to drive off R and M from unexposed regions of the film, 5) forming a second sol-gel film and said first sol-gel film and repeating steps 2), 3), and 4).

32. A method for forming an integrated optic chip including a plurality of high index of refraction channels having a longitudinal axis extending from an input to an output end, said method comprising the steps of forming an photosensitive sol-gel film including an organomatillic photosensitizer on the surface of a substrate having a surface composed of silicon dioxide, exposing said sol-gel film through a gray scale mask to radiation of a wavelength and for a time to bind differing amounts of metal constituents of said sol-gel film to said silicon oxide and to unbind said photosensitizer, said mask having different regions of opacity for each of said channels for producing in said channels differing concentrations of said metal constituents therein, heating said sol-gel film at a first temperature and for a time to drive off said sensitizer and bind said different amounts of said metal constituents to the silicon dioxide in said channels permanently, and heating said sol-gel film at a second relatively higher temperature for unbinding the organic constituents of said sol-gel film and for driving off the organic constituents.